

Office of Environmental Management – Grand Junction



Moab UMTRA Project Flood Mitigation Plan

Revision 2

May 2013



U.S. Department
of Energy

Office of Environmental Management

Moab UMTRA Project Flood Mitigation Plan

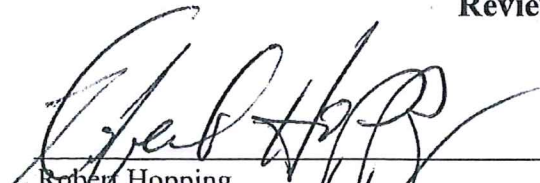
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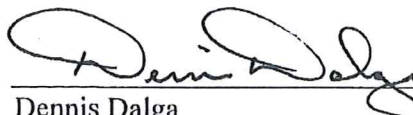
Moab UMTRA Project Flood Mitigation Plan

Revision 2


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Revision History

Revision No.	Date	Reason/Basis for Revision
0	May 2008	Initial issue.
1	May 2011	Annual update.
2	May 2013	Annual update.

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Acronyms and Abbreviations

CF	Configuration
cfs	cubic feet per second
DOE	U.S. Department of Energy
ft	feet
IA	interim action
LO/TO	lockout/tagout
msl	mean sea level
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
RAC	Remedial Action Contractor
TAC	Technical Assistance Contractor
UMTRA	Uranium Mill Tailings Remedial Action
USGS	United States Geological Survey
VFD	variable frequency drive

1.0 Introduction

The U.S. Department of Energy (DOE) Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site (Moab site) is a former uranium ore-processing facility located about three miles northwest of the city of Moab in Grand County, Utah, and lies on the western bank of the Colorado River at the confluence with the Moab Wash.

Several features of the Moab site are shown in Figure 1. The site is transected by the Moab Wash, which flows during significant storm events. North of the wash is a freshwater intake structure that supplies a pond used for irrigation, dust control, and injection water as part of ground water interim action (IA) remediation.

The IA well field is located between the toe of the tailings pile and the river south of the Moab Wash. The site is susceptible to flooding because about 160 acres of the nearly 480 acres of the property are within the 100-year floodplain of either the Colorado River or the Moab Wash.

A berm located along the Colorado River north of the Moab Wash berm and several off-pile areas of the site have been remediated. A 20-acre area north of the Moab Wash (northern off-pile area) was remediated in the winter of 2010/2011 by excavating and removing the contaminated soil. As part of this remediation, the berm that was installed along the riverbank by the previous site owner was removed. In addition, more than 158,000 cubic yards of contaminated soil were removed from this area during the remediation, creating areas of lower elevation. As was anticipated, this northern off-pile area is now more susceptible to flooding at lower river stages.

Section 2.0 of this Plan provides information about river stage and flood predictions. Section 3.0 presents the trigger points which mandate specific actions, Section 4.0 provides guidance on specific steps in flood preparation, and Section 5.0 provides guidance to the steps that should be taken after the flood water has receded.

1.1 Purpose and Scope

This Plan is intended to minimize adverse impacts on DOE-owned or managed property associated with the Moab Project from river flooding.

This plan is applicable to flooding that may occur at or near the Moab site and outlines the planning and actions to be taken by the Technical Assistance Contractor (TAC) and Remedial Action Contractor (RAC) in preparation for possible flood conditions. In the event of flooding, the *Moab UMTRA Project Emergency/Incident Response Plan* (DOE-EM/GJ1520) will be utilized. The *Emergency/Incident Response Plan* contains a Flood Action Plan checklist that includes actions to be taken (e.g., notifications, evaluations) when the RAC Operations/Site Manager calls a Flood Alert.

1.2 Background

Stream flow on the Colorado River has been collected by the U. S. Geologic Survey (USGS) at gaging station 09180500 near Cisco, Utah, since 1914. This station, located approximately 35 miles upstream of the site, is the closest station to Moab and provides the most complete data set representing river flow passing the site. There are no significant tributaries between the gaging station and the Moab site. In 2009, the Project installed a standard USGS-style river staff gage at the freshwater intake structure, just west of the freshwater pond at the eastern (upstream) end of the site. The elevation of the Colorado River surface is recorded from the gage on a routine basis.

On average, the river reaches a maximum flow between late May and early June, with an average annual instantaneous peak runoff at the Cisco gage of 27,500 cubic feet (ft) per second (cfs). Above-average runoff is attributed to a combination of above-average snowpack in the Upper Colorado River Basin, late spring precipitation events, and above-average temperatures. Peak flows within the last 50 years reached more than 40,000 cfs 12 times, with the two highest peak flows occurring in 1983 and 1984 (61,900 and 70,300 cfs, respectively).

During the springs of both 1983 and 1984, reportedly the Moab site was flooded up to the toe of the tailings pile. The most recent site flooding event occurred in 2011 (Figure 2), when the peak runoff reached 48,600 cfs (which is equivalent to a river surface elevation of 3,967.2 mean sea level [msl]) on June 9, and the river flow remained above the average annual peak flow from late May through mid-July. The impacts of this flooding event are well documented in the *Moab UMTRA Project 2011 Flood Response Summary* (DOE-EM/GJTAC2007).

1.3 Site Condition

Figure 3 represents a rating curve generated using the 2011 flows for the site based on the river flows measured at the Cisco gaging station and the corresponding river surface elevation measured at the site river intake structure.

Ground surface elevation shows a low point on the riverbank south of the freshwater pond with an elevation of 3,957 feet (ft) msl (Figure 2). Using the rating curve, the associated river surface elevation for flows above 11,000 cfs will exceed the land surface elevation at this location, allowing river water to begin to migrate into the area. Once flows exceed approximately 34,000 cfs, the low point on the berm along the Moab Wash will be topped, and river water is expected to flow to the south within the constructed channel that runs through Configuration (CF) 5 from the Moab Wash.

Observations made in 2011 included the presence of water in the area just to the south of CF5 (the former Policaro property), the direct result of water over-topping the riverbank to the south of the site and flowing back to the north. When flows reached approximately 38,000 cfs, the access road to the well field off State Route 279 was flooded.

The bank along the river from the Moab Wash down to the southern end of CF4 has an elevation that generally ranges from 3,968 to 3,969 ft msl. However, the survey identified a low spot on the berm adjacent to the area between the infiltration trench and the baseline area, where the elevation is 3,967.2 ft msl. River flows above 48,000 cfs would allow the river to flow into the well field.

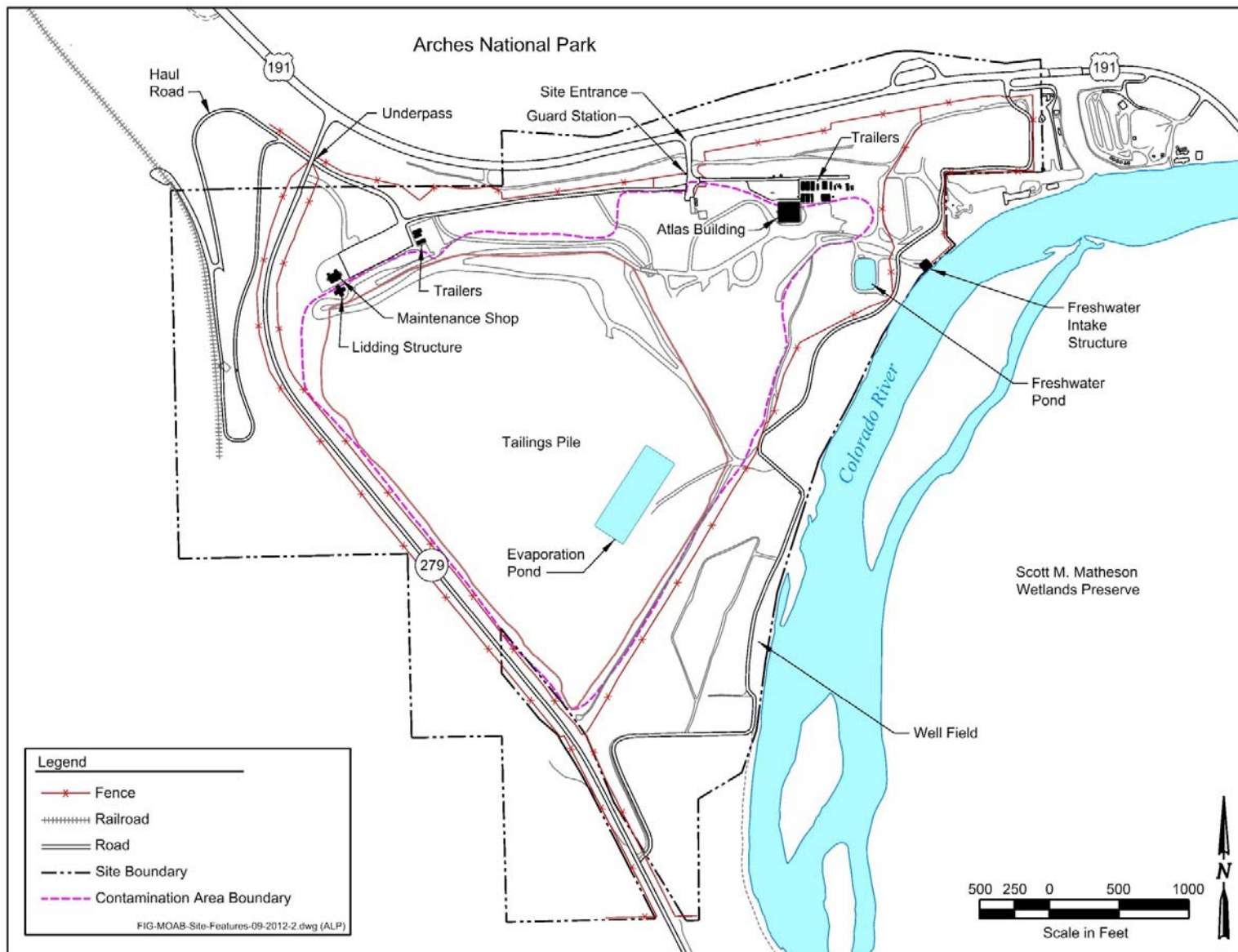


Figure 1. Moab Site Features

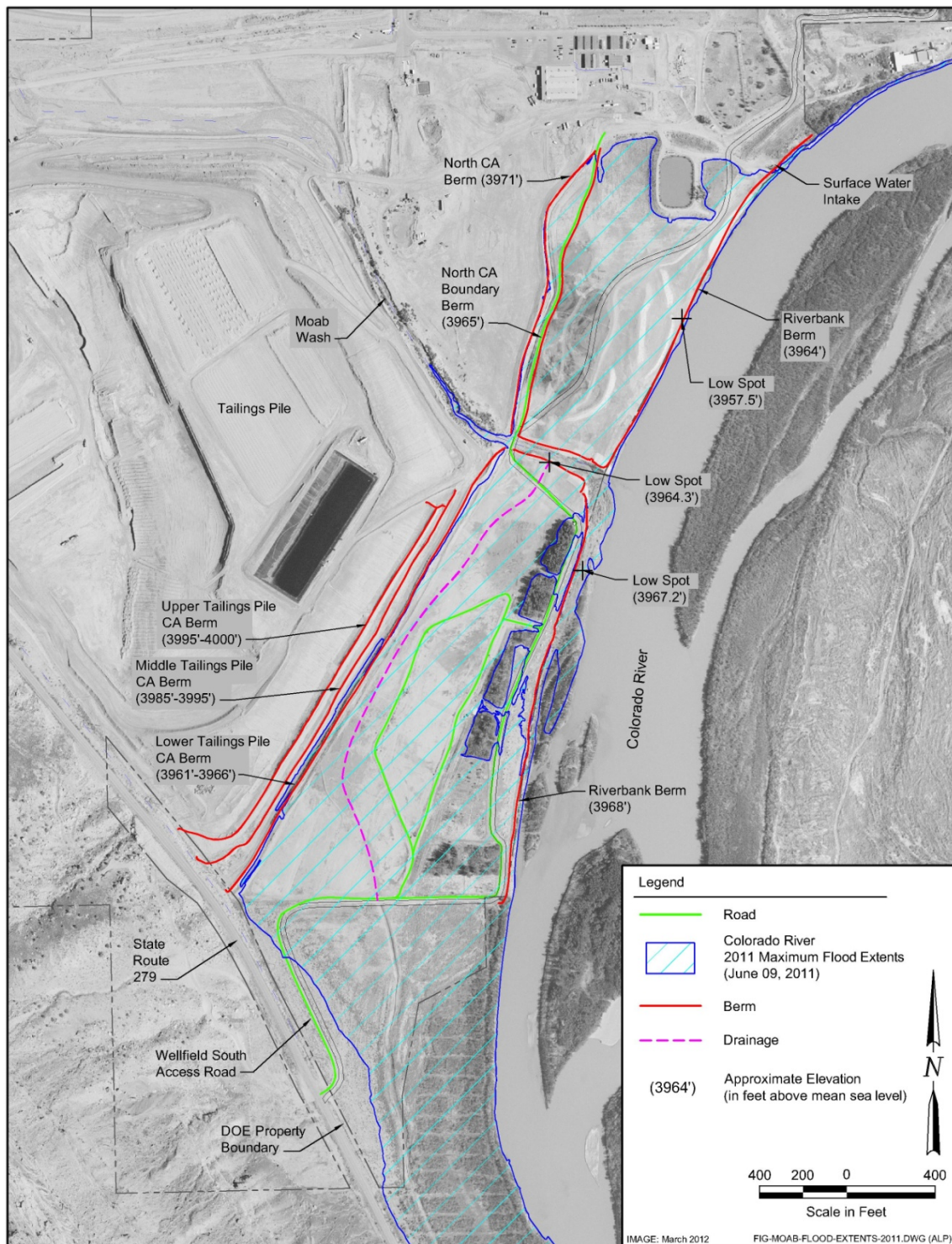


Figure 2. Moab Site Features, Colorado River Elevations and 2011 Flood Extent, and Contamination Area Berms and Elevations

Flow rates exceeding 60,000 cfs at the Cisco gage could potentially reach the toe of the tailings pile. Due to the wide girth of the river at Moab, even if inundated, there is insufficient energy in the river to adversely impact the tailings pile. Therefore, protection of the tailings pile from flooding is limited to maintaining the berms during lower river stages. Additional information is available in:

- Flood Insurance Study, Grand County, Utah. Federal Emergency Management Agency, 2006.
- U.S. Geological Survey Scientific Investigations Report 2005-5022, Initial Phase Investigation of Multi-Dimensional Streamflow Simulations in the Colorado River, Moab Valley, Grand County, Utah, 2004.

2.0 Monitoring Colorado River Stage

When river flow rate at the Cisco gage is expected to exceed 10,000 cfs, the TAC monitors the current and forecast river stage daily and reports the status to the RAC in the Plan of the Day.

2.1 Flood Designations

The National Weather Service (NWS) has a flood warning notification system that includes several flood designations applicable to the Moab site, including flash flood warning, flood warning, and river flood warning (<http://www.nws.noaa.gov/floodsafety/index>). The NWS reports forecast the river stage for 2 weeks.

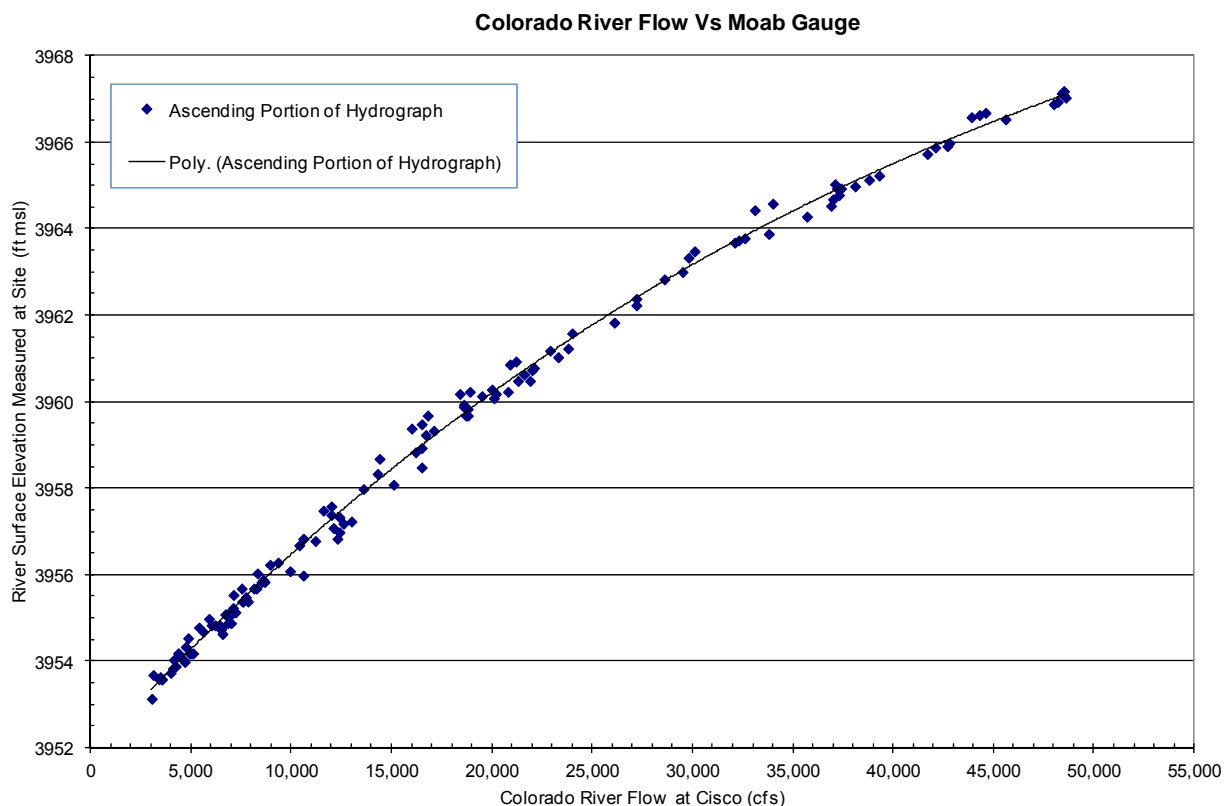


Figure 3. Cisco River Gage versus Site Elevation Gage

Each flood designation is described as follows:

- **Flash flood warning** – Issued to inform the public, emergency management, and other cooperating agencies that flash flooding is in progress, imminent, or highly likely.
- **Flood warning** – In hydrologic terms, a release by NWS to inform the public of flooding along larger streams in which there is a serious threat to life or property. A flood warning will usually contain river stage (level) forecasts.
- **River flood warning** – This warning is issued by the local NWS when the forecast points at specific communities (those that have formal gaging sites and established flood stages) or areas along rivers where flooding has been forecast is imminent or is in progress. Flooding is defined as the inundation of normally dry areas as a result of increased water levels in an established water course. The flood warning normally specifies crest information. It usually occurs 6 hours or later after the causative event, and it is usually associated with widespread heavy rain and/or snowmelt or ice jams.

The warning will contain the forecast point covered, the current stage (if it is available), and the established flood stage. From the forecast crest, the NWS determines which areas will be affected by the river flooding. This information is included in the warning that is issued as a site/event-specific call-to-action.

The TAC will monitor the NWS website and report any warnings to the RAC at the daily safety briefing or will contact the Operations/Site Manager if an immediate threat occurs.

2.2 River Stage Reporting

Estimated Colorado River flow rates for the Cisco, Utah, gaging station (based on upstream flow rates and weather systems impacting the Colorado River basin) can be monitored on the National Oceanic and Atmospheric Administration (NOAA) website at <http://www.cbrfc.noaa.gov/river/station/flowplot/flowplot.cgi?CLRU1>. Figure 4 shows an example hydrograph from the Cisco gage.

In addition, the NOAA Western Water Supply Forecast web page, <http://wateroutlook.nwrfc.noaa.gov/point/evolution?id=CLRU1&mode=r>, provides a long-term seasonal runoff volume forecast that can be closely monitored.

3.0 Decision-making for Mitigating Potential Flood Damage

Table 1 provides a summary of the critical flows, the river surface elevation, and the areas of the site that will be impacted by flood waters as discussed in Section 1.3.

To avoid unnecessary efforts and associated costs with flood preparation, specific actions are triggered by observed river flow rates and stage forecasts for the Cisco gage. Taking the historical data into account, this Plan establishes conservative trigger points for action at 10,000 cfs, 25,000 cfs, and 35,000 cfs or greater. These trigger points account for increases in flow rate that may occur over the weekend when site support is reduced.

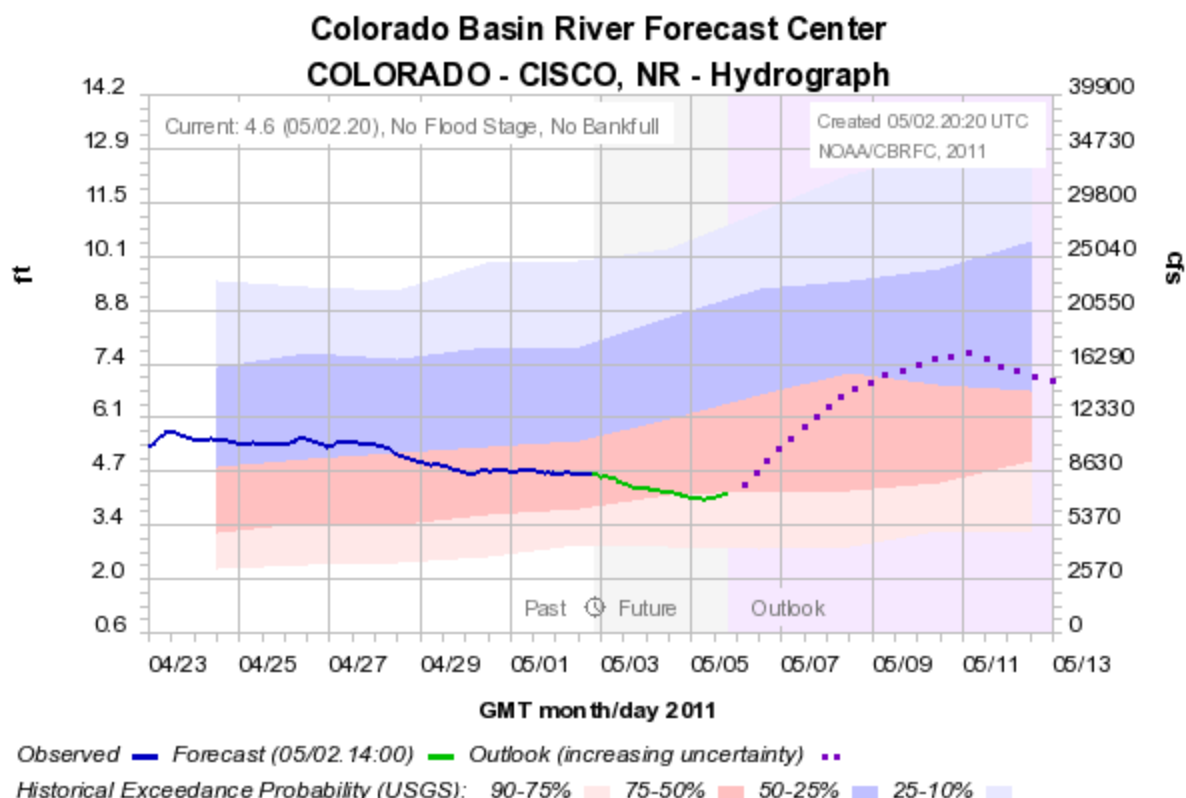


Figure 4. Example Hydrograph From Cisco, Utah, Gaging Station

Table 1. Key River Flows, River Surface Elevations, and Associated Areas Impacted

River Flow (cfs)	River Surface Elevation (ft msl)	Area Impacted
11,000	3957.0	Flood waters expected to enter site in northern off-pile area
34,000	3964.3	Flood waters expected to flow into the CF5 channel from the Moab Wash
38,000	3965.0	Flood waters expected to flow into the area to the south of CF5, flooding the road to the well field from State Route 279
48,000	3967.2	Flood waters expected to breach the river bank along the well field
60,000	~3969	Flood waters will potentially reach the toe of the tailings pile

3.1 Specific Actions at 10,000 cfs

The TAC will take the following actions associated with the well field once the Cisco gage flows are predicted to reach approximately 10,000 cfs:

- Coordinate with RAC and TAC to conduct a walkdown of areas to identify potentially vulnerable assets and establish corrective actions. Visually inspect berms and repair or enhance as needed.
- Shut down all freshwater injection into the well field when the river flow reaches 15,000 cfs.
- Verify all riverbed well point and observation well caps have been installed.
- Suspend irrigation activities in northern off-pile area, and remove irrigation equipment that may be damaged or transported out of the area by flood waters.

The RAC will take the following actions in other areas of the site once flows are predicted to reach 10,000 cfs:

- Notify RAC Moab Operations/Site Manager (or RAC On-Call Manager, during non-working hours), who will then notify RAC and TAC Technical Group/Field Manager, the DOE Facility Representative, the Federal Project Director, and TAC Public Affairs.
- Inform site security and site personnel during daily safety briefing of flood-prone areas at the site where operations will be restricted for that day.

3.2 Specific Actions at 25,000 cfs

Once the Colorado River flows are predicted to reach 25,000 cfs at the Cisco gage, the TAC will perform the following tasks:

- Notify an electrician to schedule CFs 1, 3, and 4 for potential transformer removal from the well field and variable frequency drive (VFD) removal from CF5.
- Measure water levels at each northern off-pile area location equipped with a data logger/pressure transducer. Label, download, and remove each data logger/pressure transducer.
- Shut down the well field access road across the Moab Wash when deemed unsafe (historically occurs at a flow of 24,000 cfs). All access will be through the alternative route off State Route 279.

The RAC will take the following actions in other areas of the site at the 25,000 cfs level flow:

- Remove all RAC and TAC equipment stored in low-lying areas and transport to areas of the site that will not be impacted by higher flow rates. Keep the keys to any equipment in the Administration Office.
- Remove all air-monitoring equipment from the well field.

3.3 Specific Actions at 35,000 cfs or Greater

For flows that are predicted to reach 35,000 cfs or greater, the TAC will perform the following tasks:

- Hold weekly (or more frequently as needed) meetings to discuss site actions and predicted river flow forecasts.
- Shut down all power to the well field and secure power following the *Moab UMTRA Project Lockout/Tagout Hazardous Energy Control Procedure* (DOE-EM/GJ1552) to prevent inadvertent energization to the well field.
- Record all individual extraction/injection well flow meter values. Label and remove each well head flow meter display plate.
- Have electricians remove transformers and VFDs from well field.
- Measure water levels at each well field location equipped with a data logger/pressure transducer. Label, download, and remove each data logger/pressure transducer.
- Inventory ground water shed and flammable cabinet in CF5. Remove any equipment that can be damaged by potentially rising water and relocate to higher ground.
- Contact Chad Shepherd of Williams Northwest Pipeline at 435-220-0139 to inform him that we are expecting a flow of greater than 40,000 cfs, so they will have time to remove electrical equipment from their equipment located adjacent to the river intake structure.
- Complete berm inspections for erosion and signs of breaching.
- Close the river intake pump head gate to avoid sediment from accumulating inside structure.

- If the river reaches an elevation not encountered before, then actions will be taken as warranted by the site conditions.

3.4 Specific Actions for Moab Wash During Heavy Precipitation Events

In the event of heavy rainfall events that produce visible flow in the Moab Wash, the TAC will:

- Monitor wash flow and record elevations.
- Collect samples for turbidity analysis of flow at lower wash crossing when deemed safe by Health and Safety.
- Close off access to lower crossing until flow stops and any sediment is scanned, cleaned, or removed.
- Collect samples for turbidity analysis from the Colorado River up and down stream of the Moab Wash confluence.

4.0 Specific Actions for Flood Mitigation

Representatives of the RAC and TAC will jointly observe the Colorado River bank and lower portion of the Moab Wash and associated berms to identify low points, erosional features, or loose soils that may be subject to further erosion during flooding. Objects that may be disrupted during flooding will be noted to determine if relocation or protection in place is preferred. Pay attention to possible hazardous materials (see list with security guards at the site entry kiosk) that may require special actions. The walkdown survey may result in corrective actions; any potential impacts/issues will be discussed with Operations/Site Managers, and appropriate actions will be taken.

5.0 Specific Actions After Flood Water Recedes

Once the well field is accessible and there is no longer a threat of flooding or danger, the TAC will perform the following tasks:

- Assess any flood damage on the river berm and in the well field. Complete any necessary corrective actions.
- Contact the electricians to re-install the VFDs on the CF5 wells and reinstall the transformers in CFs 1, 3, and 4.
- Return flow meter face plates to all of the wells.
- Return data loggers/pressure transducers to wells.
- Identify areas of standing water and determine whether mosquito abatement is necessary.
- Remove the LO/TO on the well field power.
- Resume well field extraction.

- Resume well field injection after the river flow drops to less than 15,000 cfs.
- A post-flood meeting will be held to discuss sediment removal from the Moab Wash lower crossing or other areas of the site and the repair of roads and berms.

The RAC will complete the following actions after the flood water has receded, and the area adjacent to the river is deemed safe.

- Radiologically scan the areas that flood for any potential contamination.
- Return air monitoring stations to the well field.

6.0 References

DOE (U.S. Department of Energy) *Moab UMTRA Project Emergency/Incident Response Plan* (DOE-EM/GJ1520), September 2012.

DOE (U.S. Department of Energy) *Moab UMTRA Project 2011 Flood Response Summary* (DOE-EM/GJTAC2007), December 2011.

DOE (U.S. Department of Energy) *Moab UMTRA Project Lockout/Tagout Hazardous Energy Control Procedure* (DOE-EM/GJ1552), October 2011.

Flood Insurance Study, Grand County, Utah. Federal Emergency Management Agency, 2006.

National Oceanic and Atmospheric Administration at
<http://www.cbrfc.noaa.gov/river/station/flowplot/flowplot.cgi?CLRU1>

National Oceanic and Atmospheric Administration Western Water Supply Forecast at
<http://wateroutlook.nwrfc.noaa.gov/point/evolution?id=CLRU1&mode=r>

U.S. Geological Survey Scientific Investigations Report 2005-5022, Initial Phase Investigation of Multi-Dimensional Streamflow Simulations in the Colorado River, Moab Valley, Grand County, Utah, 2004.